temperature of a place, other things being equal, is proportional to the heat received from the sun."

His reviewer in the *Quarterly* for July last says: "The mean January temperature of England may be taken at 39° F., which is equivalent to 278° F. of absolute temperature" (meaning, above the temperature of space taken at −239° F.), "and if we calculate what would be the mean temperature of the same month when the sun was distant 97,500,000 instead of 91,000,000 of miles as it is now, we find it comes out 242° F., which is equivalent to 3° F. of our thermometer, or 29° of frost."

If we use the same method to find to what extent the present value of the eccentricity ought, even now, to affect temperatures on the earth's surface, we arrive at a result apparently so contrary to experience that I think "there must be a mistake somewhere." I ask your readers to tell me where.

Let S be the temperature of space. Choose two places in equal north and south latitude; and let U, U' be their July temperatures respectively, A, A', their January temperatures, *i.e.*, at aphelion and perihelion; e the eccentricity. Then we have, according to the principle used by Mr. Croll and his reviewer—

$$\frac{S + A'}{S + U} = \left(\frac{1 + e}{1 - e}\right)^2.$$

With the present value of the eccentricity, viz., 0·0168, this gives—

$$A' = 0{\cdot}0695\,S + 1{\cdot}0695\,U,$$

giving to S the usually accepted value, −239° F.

$$A' = 16{\cdot}61 + 1{\cdot}0695\,U.$$

$$\therefore A' - U = 16{\cdot}61 + 0{\cdot}0695\,U \quad . \quad . \quad . \quad (1)$$

That is to say, the January temperature of the place in south latitude, ought to exceed the July temperature of the place in equal north latitude by more than 17° F.

In like manner we find the relation between U' and A to be—

$$U' - A = -15{\cdot}53 - 0{\cdot}07\,A \quad . \quad . \quad . \quad (2)$$

That is to say, the July temperature of the place in south latitude ought to be more than 16° lower than the January temperature of the place in north latitude.

Now it may be replied that geographical and meteorological causes may completely mask these differences. The mean June temperature of the northern hemisphere is known to be higher, instead of lower, than the mean December temperature of the southern hemisphere, and it is considered that this is sufficiently accounted for by the excess of land there. If this explanation be true, the effect of the excess of land must be capable of increasing the mean temperature not only by the number of degrees by which the northern hemisphere exceeds the southern, but by this amount *plus* 17° F.

Subtracting (2) from (1)—

$$(A' - U') - (U - A) = 32{\cdot}14 + 0{\cdot}07\,A + 0{\cdot}069\,U.$$

This shows that, so long as A' is greater than U' and U greater than A, this difference is greater than 32°. That is, the difference between the excess of summer temperature over winter in the southern hemisphere exceeds the like excess in the same latitude north by more than 32°. Is there any indication of an excess of annual variation in anything like this extent in the southern hemisphere?

But observe the result at the equator. If the latitudes of the two places are continually diminished they will eventually be found both of them on the equator; in which case A' and A become identical, and likewise U' and U. Now the right-hand side of the equation being positive, the left-hand side must be so too. Hence $-(U - A)$, which was negative, in becoming $A' - U'$, which is positive, must pass through zero. This shows that one effect of the eccentricity is that it is not under the equator that the January and July temperatures are the same, but under some latitude north of the equator.

When the two places are both on the equator, or rather when only one place upon the equator is considered,

$$A - U = 16{\cdot}07 + 0{\cdot}03\,(A + U) \text{ (nearly)}.$$

If we put for $\frac{1}{2}(A + U)$ the mean temperature of the equator, or 80° F., this equation gives $A - U = 21°$ F. nearly.

That is to say, the January temperature of a place on the equator ought at the present time to be about 21° F. higher than the July temperature, if the temperature of space is so low as −239° F.

The temperatures themselves would be—

$$A = 90° \tfrac{1}{2},\ U = 69° \tfrac{1}{2}.$$

I would ask, therefore, whether there is any indication of so great a difference as the above at any station on or close to the equator.

If $A - U$ is not so great as 21° F., it must be owing to causes which diminish A or increase U. The place being on the equator, would not be reached by the north-east trade-winds; moreover, in July their extension towards the equator would be least. Consequently, they would have little effect to increase U by bringing warmth from the heated continents. In a similar way the south-east trades would be at their weakest in January, and have their least effect to diminish A by bringing cold air and water from the Southern Ocean. Meteorological causes would, therefore, seem to tend rather to exaggerate than to mask the difference in question, if the observations were taken in an insular position near the equator.

I believe there is admitted to be some uncertainty about the value used for the temperature of space. Herschel's investigation in his meteorology may not be thought satisfactory. But it is remarkable that Pouillet, following quite a different method, arrived at almost the same result. At any rate the temperature which the earth would assume, were the sun extinguished, must be very low. But is it so low as −239° F.? If it were, it appears that, if the principle used be correct, those results would follow which I have suggested; and I ask whether any observations bear upon the question? It is obvious that it touches Dr. Croll's celebrated theory somewhat closely. O. FISHER

Harlton, Cambridge, October 4

Does Sargassum Vegetate in the Open Sea?

HAVING had many opportunities of observing patches of "living Sargassum in the open sea" from the deck of H.M.S. *Challenger* during her cruise in the North Atlantic in the early part of the year 1873, I venture to offer a few remarks in reply to the above inquiry of your correspondent in NATURE, vol. xx. p. 552. The track of our ship between Madeira, the Canary Islands, St. Thomas in the West Indies, Bermudas, and the Azores is almost equivalent, as a glance at the map will show, to a complete circumnavigation of the central part of the North Atlantic generally known as the Sargasso Sea. During this cruise *Sargassum bacciferum* was met with frequently so as to render the appearance of this seaweed a sight quite familiar to all on board the *Challenger*. It was first seen on March 2 in about lat. 22° 30′ N., long. 42° W., halfway between the Canaries and the West Indies. Again on March 6, lat. 21° N., long. 49° W., quantities of gulf-weed drifted past the ship. On more than one occasion large patches of Sargassum were observed extending from the vicinity of the vessel to a great distance. The gulf-weed was also encountered between St. Thomas and the Bermudas group, and was last met by us between the latter islands and the Azores on June 18, lat. 35° N., long. 53° W.

As regards the exact form and appearance of this interesting alga, I cannot do better than quote from the graphic description given by Sir C. Wyville Thomson in the pages of "The Atlantic," vol. ii. pp. 9, 10:—

"They (the patches) consist of a single layer of feathery bunches of the weed (*Sargassum bacciferum*), not matted but floating nearly free of one another, only sufficiently entangled for the mass to keep together. Each tuft has a central brown thread-like branching stem studded with round air-vesicles on short stalks, most of those near the centre dead, and coated with a beautiful netted white polyzoon. After a time vesicles so encrusted break off, and where there is much gulf-weed the sea is studded with these little separate white balls. A short way from the centre, towards the ends of the branches, the serrated willow-like leaves of the plant begin; at first brown and rigid, but becoming farther on in the branch paler, more delicate, and more active in their vitality. The young fresh leaves and air-vesicles are usually ornamented with the stalked vases of a *Campanularia*. The general colour of the mass of weed is thus olive in all its shades, but the golden olive of the young and growing branches greatly predominates. The general effect of a number of such fields and patches of weed, in abrupt and yet most harmonious contrast with the lanes of intense indigo which separate them, is very pleasing."[1] On p. 339 of the same volume we find the following remark:—"Very few of the higher algæ live even occasionally on the surface of the sea; the notable exception is the gulf-weed

[1] "The Atlantic," by Sir C. Wyville Thomson. (London: Macmillan and Co., 1877.)

(*Sargassum bacciferum*), which scatters its feathery islets over vast areas of warm, still water; and affords rest and shelter to the peculiar nomadic fauna to which I have already alluded (vol. i. p. 186, &c.)."

My colleague on board the *Challenger*, Mr. H. N. Moseley, on p. 567 of his recently-published "Notes by a Naturalist,"[1] refers to the pelagic habits of Sargassum and other sea-weeds in the following words:—

"Besides these smaller algæ (*Trichodesmium*) living in the open ocean, there are abundance of several species of larger sea-weeds which are pelagic in habit. The Gulf-weed, *Sargassum bacciferum*, of the Sargasso Sea in the Atlantic, is well known. It is brown when dried or preserved, but when living is of a very bright yellow colour, which contrasts pleasingly with the deep blue of the open Atlantic. Another sea-weed (*Fucus vesiculosus*) is to be found also living free in the Atlantic, and the Giant Kelp (*Macrocystis pirifera*), in the floating condition, ranges over a wide belt of the Southern Ocean, as proved by Sir Joseph Hooker ('Flora Antarctica,' vol. i., pp. 464-465).

"All these sea-weeds grow attached to rocks on various shores as well as free, but they all produce spores, only when attached. The pelagic varieties multiply only by simple growth and subdivision. A wide area covered with sea-weeds corresponding to the Sargasso Sea occurs in the North Pacific Ocean."

In refutation of one of the fanciful reports alluded to by your correspondent, namely, that some branches of the floating Sargassum rise two inches above water, and are thus driven along by the wind, I may add that the bunches of the Gulf-weed float at, but not upon, the sea-surface, being almost completely immersed in the water, and often entirely so. At times, when a patch of weed is seen crowning the top of a wave, the tips of the feathery bundles protrude above the water, without, however, presenting a surface large enough for the wind to act upon. Probably, owing to the action of surface-currents, an apparently endless procession of patches, large and small, may be often observed drifting past the ship, forming in the aggregate long yellow streaks or bands, which cover the sea as far as the eye can reach.

J. J. WILD

The Temple of Nodens in Lydney Park

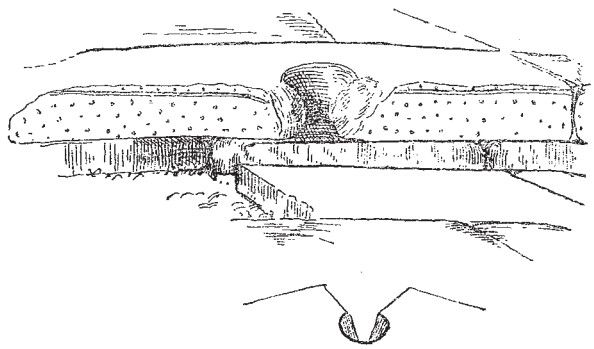
PROF. RHŶS' interesting review on Mr. King's volume in NATURE, vol. xx. p. 285, has been recalled to mind by the notice of the same quarto in Saturday's *Athenæum* (September 27); and I would remind those interested of the occurrence of a somewhat analogous relic of ancient rites in the pavement of the primæval fane on the island of Gozo; which relic was first (I believe) noticed by myself in the pages of the *Athenæum* in November, 1872. A fuller account, with diagrams of the pavement, appeared subsequently in the *Journal* of the Anthropological Institute, vol. iv. (Plate vi.) in a paper on the "Non-historic Stone Relics of the Mediterranean."

Prof. Rhŷs writes: "We have not yet done with the pavement, for in the part occupied by the dedicatory inscription, but not quite in the centre, seemingly not to cut up the names, as Mr. King thinks, there is what he describes as 'a circular opening, nine inches in diameter, surrounded by a broad red band again inclosed in two others of blue.' That some high mystery was involved in the setting of this unsightly object in so conspicuous a position, cannot admit of any doubt." He comes to the conclusion that this funnel was meant to receive libations poured to the god, and that they were drunk up by the dry soil beneath. He further compares this opening in the pavement "to the well of salt water, that famous memorial of the former presence of Poseidon in the Acropolis of Athens."

Compare this with my account of the Gozo pavement in 1872, as follows:—

"In the pavement of the inner left-hand pair of chambers at Gozo, to the right are the partially-covered remains of a large stone basin, or hollowed stone with a broad raised brim, and in the threshold of the entrance, between the two chambers, a broken holed stone, at the base of which was some coarse burnt clay, hollowed so that the stone could hold water. At Hagiar Khem these holed stones or stone rings are frequent, and may have been used for holding the pins on which the valves of heavy doors turned, or, more probably, may have served to support earthenware *amphoræ* or *cadi*, with pointed bases, as was commonly the practice amongst not only the ancient Egyptians, but also the Greeks and Romans.

"The most unaccountable feature, however, in the whole of the monuments is to be found in the central stone of the platform of the centre apse at Gozo, right opposite to the entrance of the left-hand pair of chambers. This consists in a curious *funnel-shaped*



concavity, with one side cut away to the edge of the step of the platform of which it forms part. It is sharply cut, and in tolerable preservation, and seems designed as a species of socket in which some portable pillar, pole, altar, or vase could be fitted and fixed, or unshipped and replaced, on separate occasions. The reader may suggest some more practical use for which it may have been intended."

Accordingly, I would now adopt Mr. King's suggestion that, like the terra-cotta funnel fitted into the similar orifice at Lydney, it was meant to receive the drink-offerings of blood or libations of wine poured to the "god of the deeps." Anyhow, this would add effect to the surmise that a primæval fane of huge stones (very doubtfully *Druidical!* may I suggest *Phœnician?*) had been converted into a Roman temple for the benefit of the Latin-speaking iron-workers, "*prope Sabrinum ostium.*" The *Athenæum* reviewer reminds Mr. King that there is no *classical* authority that connects Druidism directly or indirectly with any stone temple or megalithic remains, adding, however: "*The dolmens of Wales are probably posterior to the withdrawal of the Romans.*" What authority can he claim for this except Mr. Fergusson's Arthurian myths from the Welsh triads in Herbert's "Cyclops Christianus." I should be glad if Prof. Rhŷs would deal with this question, and ask if he can reconcile the following theories of Fergusson in his "Rude Stone Monuments":—

1. The post-Roman dolmen-builders came "from the south, first touched in Cornwall, and thence spread northwards, settling on both sides of St. George's Channel, and leaving traces of their existence on the south and both coasts of Ireland, as well as in Wales and the west of England generally" (see p. 274).

2. The Siluri and Brigantes emigrated from Spain to the banks of the Severn 261 years before our era (p. 381).

3. "We find the Bryts beginning to use stones after having been driven from the fertile plains of the east into the fastnesses of Cumberland and Wales; so we find the Spaniards first adopting rude stone monuments after having been driven into Portugal and the Asturias" (p. 380).

4. Locqmariaker and the monuments of the River Boyne were all erected in the first four centuries after Christ (p. 370).

5. The Crozon and Carnac monuments ascribed to the Arthurian age, 380–550 A.D. (p. 375).

6. The dolmen of Confolens: "It is a dolmen pure and simple, and it was erected in the twelfth century" (p. 336).

The Phœnicians, who dealt with the tin-workers of Cornwall, must have been amongst the first navigators who explored the banks of the Severn and recognised the mineral treasures of the Forest of Dean.

S. P. OLIVER

P.S.—Since writing the above I notice that M. Carapanos and M. Foucart found certain lead plates from the ruins of Taracovista (the ancient Dodona), on which petitions similar to that of Silulanus are inscribed; for instance, one Agis consults the great Zeus on the subject of his pillows and blankets, which he has lost or had stolen from him; whilst another, a shepherd promises his gratitude to Zeus if he succeeds in rearing his sheep, &c. These tablets and bronzes found with them were exhibited at Paris last year. The great Dodonian Zeus therefore

[1] "Notes by a Naturalist on the *Challenger*," by H. N. Moseley, M.A., F.R.S. (London: Macmillan and Co., 1879.)